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ANNUAL
REPORT
OF THE
CANAL COMMISSIONERS,

M. Ulshoeffer

1819-

Communicated to the Legislature,

JAN. 25, 1819.

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REPORT, &c.

To the Legislature of the State of New-York: In obedience to the act, entitled "An act respecting navigable communications between the great Western and Northern Lakes and the Atlantic Ocean," passed April 15th, 1817, the Canal Commissioners most respectfully Report,---

In relation to the Erie canal,—

That, after a winter of unusual severity, followed by excessive rains in the spring, they had the satisfaction to find, when they commenced their operations for the last season, that those parts of the canal-line which had been finished, or nearly so, by the labors of the preceding year, had suffered very little; so that their apprehensions of injury to the banks of the canal, from the breaking up of winter, under the most unfavorable circumstances, are considerably diminished.

Between the Mohawk and Seneca rivers, a great portion of the canal-line passes through swamps and marshes, or along their southern margin. And this location, though it will eventually prove of great importance, in reclaiming large tracts of the richest bottom-lands, by intercepting the waters which have heretofore inundated them, was yet attended with the serious disadvantage, last spring, of enabling the weather to prevent the contractors from prosecuting their work, with any success, to a late period. Actuated by a laudable determination to omit no means in their power, of a punctual compliance with their engagements, several of the contractors had continued to labor on their jobs all winter: and by their experience it is sufficiently ascertained, that in deep cuttings, in embankments, and where the ground is constantly watered by warm springs, or so covered by vegetable matter as to protect it, in a great measure, from freezing, such labours may be carried on profitably during the coldest months of the year. From motives of economy, and because most of the roads by which the route of the canal is intersected, between Utica and Salina, are nearly impassable in the summer season, many of the contractors had purchased, in advance, large stores of subsistence for their men and cattle, and transported them to the proper places on the canal-line, by sleighing. But this wise and prudent measure was rendered almost unavailing, as to any advance of the work, by uncontrolable events. The surface of the earth was beaten and drenched, by heavy and frequent rains, from the melting of the snow, till near the first of June. During a great part of this time, the stores of the contractors were decreasing, and their expenses were accumulating, while their work was at a stand. The effects of this state of things were equally detrimental and disheartening. But, with the commencement of the summer, the weather became favorable, and since that period, the canal business, in all its branches, has advanced, with economy and rapidity.

The same causes which obstructed the efforts of the contractors, retarded those of the engineers. In the course of the fall of 1817, the country west of the termination of the Rome level, had been examined, in several directions, to a considerable extent; in order to discover, if practicable, some means of obviating the great expense of the Salina embankments, and the serious hazards, as well as much greater expense, of the deep cutting, through the marl meadow, in the town of Camillus. From these examinations, there resulted a deep impression of the difficulties presented at these places, especially at the latter. When the canal-line was run through the marl meadow, in 1816, the season had been uncommonly dry; and, though a deep cutting three miles in length, through light, soft and porous materials, gradually swelling to fifteen feet in the centre, above the bottom of the canal, could never be regarded without solicitude, the appearance of this, upon every subsequent inspection, has been more formidable and repulsive. When the past season, however, had so far advanced as to admit of a renewal of these examinations, they were more extensively pursued: and at length, the acting Commissioner, upon whom was cast the responsibility of settling the line in that part of the route, in full accordance with the conviction of the Engineer of the Middle Section, and his Assistants, determined, that two alterations from the line of 1816, were expedient. These alterations were not adopted, without a careful ascertainment and collation of facts and circumstances, which, upon much deliberation, were deemed decisive by them.

The first of the alterations consists of sinking the canal-line, across the Salina plains, six feet lower than had been at first proposed. This alteration requires the construction of an additional lock of six feet lift, on each side of these plains; but, by affording sufficient excavation, in the canal, for the formation of the adjacent banks, it altogether supercedes the necessity of embankment, for about a mile and a half; and where embankment is still requisite, its height is materially diminished. The same diminution is also obtained in the height of an arched bridge, and the largest stone aqueduct to be erected between Utica and the Seneca river. This alteration was recommended, chiefly, by the following reasons.

1st. It produced a saving in expense, estimated at seventeen thousand dollars. This estimate does not include damages to the lands, through which the canal-line is laid, which would probably have been claimed, to a large amount, for the half mile adjoining Onondaga creek on the east, in case the original plan had been pursued. The land, along the half mile referred to, had been laid out into village lots, upon which the owners set a high value; and one tier of these lots, on each side of the canal, must have been dug over and defaced, in order to obtain the earth necessary for the embankment.

2d. It renders the canal more secure. Embankments are, in general, more liable to accidents than other parts of a canal; and whenever breaches are effected in them, the usual consequences are more injurious.

3d. It will facilitate the construction of a side cut to connect the main canal with the salt works, at the village of Salina, by approaching nearer to a level with those works, in that part of the line to which they are most contiguous.

4th. It will promote the convenience of all those people, who, from the fertile country on both sides of the canal, shall hereafter have occasion to communicate therewith, on the Salina plains. These plains, for the most part, consist of a dry, coarse gravel, mixed, to the depth of three or four feet, with sand and loam, and constitute, from the nature of their soil, as well as from their local situation, an excellent site for business. There is little doubt but they will soon become the scene of extensive dealings.

The second alteration consists, in the establishment of a new summit level, extending from the Nine-Mile creek to the Skeneateles out-let, a distance of between eleven and twelve miles, and involving the construction of two additional locks, of eleven feet lift each, but relieving the line from all the difficulties of the marl meadow. There are three unfailing and pure streams naturally flowing across this level, either of which, at this period of considerable drought, affords water enough for its supply: but if, collectively, they should hereafter prove deficient, the two copious creeks, which bound the level, may be easily conducted into it. Having satisfactory assurance of this essential fact, this alteration was adopted,

1st. Because it produces a saving in expense, estimated at seventy-five thousand dollars, without taking into the account the charge of lining both banks, for the purpose of sustaining them, with solid earth, brought from a great distance, an operation which the character of the marl meadow would undoubtedly have rendered necessary, to a large extent, if the primary designation of the canal-line had been adhered to.

2d. Because, at the Nine-Mile creek, it admits of the substitution of stone arches, in the aqueduct, instead of a wooden trunk; and, at the Skeneateles, of an entire stone aqueduct, in place of a dam with guard locks. At both of these places, excellent stone are contracted for, at reasonable prices.

3d. Because, it carries the canal-line farther south, and nearer to the populous and productive settlements of the western part of Onondaga county.

4th. Because, it was very much feared, that the completion of the canal, upon the old plan, could not be effected, so as to render it navigable, as soon as it might be, upon the new, by at least one year. This would have been discouraging to the public spirit, by which this great enterprize is supported, and a serious delay of the profitable returns, which may be expected, whenever the communication between the Mohawk and Seneca rivers, is all the way opened. And the reasonableness of such a fear is manifested by the following considerations: The Marl-meadow is a swamp without any outlet, except at its eastern and western extremities; and as it contains great quantities of water, proceeding from Hand's brook, and numerous springs, which run into it, the only possible mode of excavating the canal through it, would be, to begin by opening a wide drain at each end, below the bottom of the canal, and prosecuting the work from these points towards the centre, taking especial care, as advances should be made, to keep these drains free from all obstructions. The common mode of executing a heavy job of this kind, by stationing numerous parties of labourers upon it, at short distances from each other, could not be adopted here: for besides the difficulty of transporting every barrow of earth a great way, upon a soft and wet surface, all such parties, except one at each end, would soon find themselves at work in a pond, in which the depth of water would increase in the same ratio with that of the excavation. No cattle or horses could be employed; and as the parties, at both ends, could not advantageously include more than seventy or eighty hands, it is evident, that so great a labour, even without the occurrence of any untoward events, would require the application of all practical exertions, during several years, for its accomplishment. But, it must be acknowledged, that the depth of the cutting, the weight of the spoil-banks, the quantity of water with which the swamp is filled, and the nature of the earth, which is ascertained, by frequent borings, to be chiefly vegetable matter, marl, and sand, are circumstances connected with the old plan, calculated to render untoward events, affecting both the cost and time within which the canal could be constructed, and its security, afterwards, extremely probable.

5th. Because there is no part of the Middle Section, of the same length, where the whole expense of opening the navigation will be less than that of the new summit, between the locks.

From the Skeneateles outlet to the Seneca river, the survey and location of the canal-line was easy; and this last portion of it was finally completed by the middle of July. The whole was judiciously divided into short sections, and perspicuously exhibited in maps, profiles and descriptions, which are herewith presented.

The avidity with which great numbers of wealthy and respectable citizens sought contracts, was highly gratifying, and afforded a sure pledge of the energy which has since been displayed in their execution. Many applications, for every section, were always made immediately after, and often before, the returns of the engineer had been received, so as to render it proper to let them out. A very few of the contractors are foreigners, who have recently arrived in this country; but far the greater part of them are native farmers, mechanics, merchants and professional men, residing in the vicinity of the line; and three-fourths of all the laborers were born among us.

Within a few days after the survey had been extended to the west end of the Middle Section, the whole was taken up, except a few short places necessarily left, where structures of wood and stone were to be erected. But as it requires two or three weeks after a section is agreed for, to construct tools, collect provisions, hire hands, purchase teams, and provide the necessary shelter, it was not till about the tenth of August that the whole line became a scene of the most animated and laborious exertions. From that time to the tenth of December, between two and three thousand men, with half as many horses and cattle, and a considerable variety of mechanical inventions, have been unremittingly employed upon it: And the diligence, ingenuity, and good judgment, with which these means have been applied would hardly be credited, if they did not rest upon a testimony impossible to be doubted, that of the effects produced.

Machinery has hitherto been used, with most success, in the heavy business of grubbing and clearing. By means of an endless screw, connected with a roller, a cable, a wheel and a crank, one man is able to bring down a tree of the largest size, without any cutting about its roots. For this purpose, these means are all, except the cable, combined in a small but very strong frame of wood and iron.— This frame is immovably fastened on the ground, at a distance of perhaps one hundred feet from the foot of the tree, around the trunk of which, fifty or sixty feet up, one end of the cable is secured, the other being connected with the roller. When this is done, the man turns the crank, which successively moves the screw, the wheel and the roller, on which, as the cable winds up, the tree must gradually yield, until, at length, it is precipitated by the weight of its top. The force which may be exerted in this way, upon a tree, is irresistible, as with the principle of the wheel and the screw, by the application of the cable at a point so far from the ground, it unites also that of the lever.

There is no grubbing so difficult and expensive, by the common methods, as that of sound, green stumps; and as our citizens, west of Utica, are every day multiplying these evidences of their industry, it was desirable to discover some easier means of eradicating them. Such means have been found; but the cost of the machinery, in which they partly consist, would forbid the use of them in ordinary cases. Two strong wheels, sixteen feet in diameter, are made and connected together by a round axle-tree, twenty inches thick and thirty feet long; between these wheels, and with its spokes inseparably framed into their axle-tree, another wheel is placed, fourteen feet in diameter, round the rim of which a rope is several times passed, with one end fastened through the rim, and with the other end loose, but in such a condition as to produce a revolution of the wheel whenever it is pulled. This apparatus is so moved as to have the stump, on which it is intended to operate, midway between the largest wheels, and nearly under the axle-tree; and these wheels are so braced as to remain steady. A very strong chain is hooked, one end to the body of the stump, or its principal root, and the other to the axle-tree. The power of horses or oxen is then applied to the loose end of the rope abovementioned, and as they draw, a rotary motion is communicated, through the smallest wheel, to the axle-tree, on which, as the chain hooked to the stump winds up, the stump itself is gradually disengaged from the earth in which it grew. After this disengagement is complete, the braces are taken from the large wheels, which then afford the means of removing that stump out of the way, as well as of transporting the apparatus where it may be made to bear on another. The expense of the wheels, axle-tree, chain and rope, is about two hundred and fifty dollars; and with them, in this way, seven hands and a pair of horses, can grub from thirty to forty large stumps in a day. A few stumps have been found to require the strength of four horses. The gain of power, by this machinery, is somewhat more than eight fold, with very little loss by friction.

Great obstruction to the excavation has been offered by the small roots and fibres which overspread the surface, and every where penetrate the top soil of timbered land. A plough has been invented for cutting up these, greatly superior to the one in common use. It is very narrow or thin, and consists of a piece of iron much heavier than a common plough, strongly connected, at its upper edge, with the beam, and in the rear, with the handle, both of which are of the usual construction.—The front edge of the iron, where the cutting is to be done, is covered with steel, well sharpened, and shaped like the front of a coulter, except that it retreats more as it rises to the beam. The lower edge is made smooth, and gradually thickens as it extends back towards the handle, to about four inches. Two yoke of oxen will draw this utensil through any roots not exceeding two inches in diameter; and by moving it, at short intervals, through the surface of any ground to be excavated, the small roots and fibres are so cut up as to be easily picked and harrowed out of the way of the shovel and scraper.

The experience of two seasons, embracing all those operations concerning which we had most anxiety, has abundantly confirmed our most favorable hopes, in relation to the construction of the canal. But we do not feel ourselves at liberty, in this report, either to conceal or to disguise the fact, that in several places unexpected obstacles have been presented. There have been frequent spots of hardpan, through most of which, however, the excavation is already completed. At the Oriskany-hill, in the neighbourhood of Rome, and on sections 15, 16, 17, 23 and 64, we have been troubled with quicksand. In some of these places, by a slight alteration of the canal-line, we have, in a great measure, avoided the evil; and what we could not avoid, we have overcome: In the others, such progress is made as leaves us no fear of the result.

On sections 27, 37 and 40 considerable quantities of breccia, or gravel firmly cemented together, have occurred. This substance is the most stubborn and expensive to break up of any that we have found. Some of it we have contrived to shun, and the rest is chiefly removed.

But we have been subjected to the most accumulated expense by indurated clay, and stone, of various descriptions. The indurated clay is either red or blueish, and has shown itself, to the greatest extent, on sections 14, 20, 24, 25, 50, 51, 54 and 55, all of which are in great forwardness, and will surely be finished before next August. The stone is all, either gypsum, common limestone, or a kind of meagre limestone. Of the last we expect to make a very important use; as, by a number of small experiments, in which, after being thoroughly burnt and slaked, or ground, and mixed in equal portions with sand, it appears to form a cement that uniformly hardens under water. The gypsum is found on sections 27, 28 and 59; the common limestone on sections 19, 23, 24, 27 and 33; and the meagre limestone, on sections 27, 31 and 37. The greatest part of all this stone is now excavated; and where it is not, it probably will be in two months, as a number of men are daily at work in it.

Besides the additional cost of the foregoing contingencies, we have, in several instances, by enlarging the plans upon which our original estimates were formed, or by procuring more durable and better materials, for their construction, contributed to swell the expense of our operations; yet we are firmly persuaded, that the savings we have made, and the economy we have pursued, will enable us to complete the Middle Section at an amount not exceeding the sum total of those estimates. The better to justify this persuasion, in the minds of your honorable body, we beg leave to refer to the detailed statements, hereto annexed, exhibiting the names of the contractors, the nature of their contracts, the progress made in executing them, and the amount of payments upon them, together with a variety of other particulars tending to explain the true condition of the work confided to our management.

While the labours of this great section have been thus going on, the following system has been adopted, to instruct, to inspect, to advise, and to aid, the contractors. The whole line has been subdivided into five parts, to each of which has been assigned an intelligent, active and vigilant overseer, or assistant engineer, who had previously learnt; the use of the levelling instrument; an accurate method of designating the dimensions of the canal, upon every variety of surface; the general principles necessary to ensure the best construction; and the nature of the stipulations contained in the several contracts.—These assistants have been constantly passing backwards and forwards, within the limits assigned them; to stake out the width of the grubbing and clearing, of the excavation or embankment, and of the mucking from under the banks; to fix pegs in the earth, shewing the depth and width of the bottom of the canal, and the height and slope of its banks; to watch that no work should be done unfaithfully; and to take account of, and measure, all unforeseen obstructions.

The original selection of these assistants was in most cases fortunate; and where it was otherwise, the delinquent was soon detected and removed.—Two of these assistants, Canvass White and Nathan S. Roberts, having had more extensive experience to qualify them for it, besides the services above indicated, have been employed in others of a highly responsible character.

Mr. White has run a test-level throughout the long summit, which became necessary in order to correct some errors into which the work was falling, between Rome and Utica. He aided essentially in performing the surveys, on the authority of which, the alteration was made in the town of Camillus: he has scientifically examined two routes, upon different levels, for the distance of several miles down the Mohawk river, for the purpose of enabling the commissioners to determine, more judiciously, the location of the canal-line through the village of Utica; and he has recently, in the months of November and December, explored, with the level and compass, more than thirty miles of the country, in the marshes, swamps and woods, adjoining the Seneca river, on the west. This last service was undertaken with alacrity, and executed with skill and perseverance, at the request of the acting commissioners, who, though the weather had become severe, were very anxious, while the waters were low, to obtain all the information required, in order to the proper connexion of the line with the Seneca river, on the east, which could not be ascertained without first knowing the proper continuation of it, from that point westerly, whenever that shall be authorized. Of these services accurate and full returns have been made, in descriptions, maps and profiles. And the Commissioners were most agreeably disappointed, on inspecting them, as well as on personal examination upon the spot, by two of their number in company with the principal engineer, to find, that the Cayuga marshes, and the swamps beyond, will admit the canal to be constructed through them at less than the average rate of expense.

Mr. Roberts had been employed, as surveyor, throughout the Middle Section, in the year 1816; and understanding the difficulties and facilities of the line then run, he has, the last year, conducted the operation of levelling and designating the canal-line, as it is actually established, most of the way from Salina to the Seneca river. And with the aid of the principal engineer, who often visited, communicated with, and advised him, especially at all the important points, the line is laid out in the manner and direction most approved.

The department of principal engineer, for the Middle Section, is still filled by Benjamin Wright, Esquire, to whom all the assistants are subordinate and accountable; and who, besides inspecting the whole line as often as possible, has devoted his time, to a minute examination of all the most difficult places; to contriving modes and giving directions best adapted for subduing these difficulties; to forming plans, and executing drafts, of all the more artificial works; to computing, from time to time, as jobs have been successively completed, the number of cubic yards of excavation and embankment performed upon them; and to estimating, determining and certifying the value of extra labor, of every species, necessarily done upon any of the sections. These duties have expanded into an immense multiplicity of detail: They have been delicate, arduous and fatiguing: But they have been discharged by Mr. Wright with such practical knowledge, industry, equity and discretion, as to deserve the praise of the state, while they have produced no complaint from the contractors.

Several other agents have been appointed, for the transaction of business, which could not safely or conveniently have been done without them.

One has had the care of making and using machines for piling, and of digging out and preparing the foundations of the stone culverts and aqueducts.

This last being a business so liable to contingencies, and so necessary to be conducted with a faithful adaptation to circumstances, which could not be known until it was in progress, that it was thought unsafe to have it done by contract.

Another has been employed in making a large number of agreements, for piles, for timber, for plank, for sand, for lime, and for fencing the canal; and in obtaining cessions to the state of the lands through which it passes.

Another was charged to explore the country within a reasonable distance of the canal, for stone, previously to any undertaking, for the delivery of that article, in order that we might surely understand where the best quarries were situated, and also be able to purchase the stone without being subject to exorbitant demands. This agency was afterwards continued for the purpose of inspecting and rough hewing the stone, as they were quarried.

Another, who had formerly been familiar with canals in England, and who assisted in the construction of that at Rome, was entrusted with placing and securing the iron culverts, and with carrying into effect the process of pudling around several of the stone works.

Having seen the locks at Waterloo, and the other improvements, adapted to facilitate the navigation of the Seneca river around its falls; and requiring more aid than we had provided for the superintendance of works, of a nature allied to those, we engaged the services of Marshall Lewis, Esq. under whose direction those improvements had been made. He has been occupied chiefly with the foundations, at the Limestone, the Butternut, and the Oneida creeks, which are completed; and with those of the Skeneateles, and Owasco out-lets, which are now advancing. The mechanical skill of Mr. Lewis, arising from much native ingenuity, and long experience, applied, particularly, to canals and hydraulic structures, has afforded us many advantages.

The general direction and regulation, of all these departments of action, constitutes no light charge; but it does not limit the responsibilities of the Commissioners along the line. It has, moreover, been their duty, to negotiate all the important agreements, and reduce them to writing, with the necessary specification of the manner of their execution, in all their variety of particulars. In concluding these agreements, they have regarded it as essential to give such prices as would induce men of enterprise, resource and perseverence, to engage with them, and, at the same time, enable them to win, for the canal, more universally, the favor of the legislature, by the frugality of their expenditures. To effect this, they have labored earnestly, to understand the true nature, and the real value, of every item, both of material, and of service, entering into the subject matter of their agreements; and to impart, to all applicants for contracts, every information in their power. When contracts were made, in order to insure the greatest economy of execution, advances of money have always been offered, upon reasonable security; and though no stipulation, requiring it of them, is contained in any contract, the Commissioners have never failed to pay each contractor, as often as once a month, the amount of his earnings. For this purpose, they have personally gone over the whole line, and estimated the advances of the work, on the several jobs: and while they have thus, by frequent payments, encouraged the contractors, and, by undeviating punctuality, exerted a favorable influence, upon all new negotiations, they indulge the belief, that no cases have occurred, in which losses will be sustained, in consequence of imprudent disbursements.

Among the great number of contractors for the Middle Section, there are a few persons, who have altogether failed; and also a few, who have found, although they are still at work, that they have undertaken more than they can perform. Most of these persons were exceedingly injured, by the extraordinary wetness of the last spring and the fall before, and some of them were disabled, by the pressure of pre-existing embarrassments. The unfinished and most difficult parts, of their sections, are now all placed in the very best hands, having been taken up by such of the original contractors as had finished, or made greatest advances, on their own jobs.

In making canals in Europe, it is generally an object of great solicitude, and much of the expense is incurred, to construct reservoirs, and controul waters, enough for their supply: in making ours, we are much more anxious, to divert and waste those, which are superfluous. With a country of, from fifteen to sixty miles wide, stretching its whole length, and abounding with lakes and streams, which all seek their natural discharge by crossing it, no deficiency of water can ever be apprehended. But, to secure our work from injury, by floods and freshets, that will often suddenly collect, from the extensive land-drain, and the abundant waters, above alluded to, we have been compelled to make numerous culverts and waste-weirs. The office of a culvert is, to pass waters, not wanted for navigation, under the canal; that of a waste-weir, to discharge the extra waters, which may be in it. We have provided for eight large culverts, of stone, and fifteen smaller ones, of iron: and there are thirteen aqueducts, which necessarily leave capacious water-courses beneath them. Of waste-weirs, there are seventeen, stretching, on the north side of the line, in the aggregate, a length of eighteen hundred and sixty feet. The expense, of these last, was not included, in our original estimates; for there are besides, eight wooden aqueducts and a dam, occupying together, a length of thirteen hundred and fifty feet, which perform the same office. An aqueduct is designed to carry the waters, to be navigated in a canal, over the rivers, creeks or ravines, which cross its route; it must, therefore, be adapted to the proper level, and to the width and depth, of the canal. Of these, the whole number, between the Mohawk and Seneca, will be thirteen, of which five, are to consist exclusively of stone, and eight, of wooden trunks resting on stone abutments and piers. The iron culverts are actually laid, and the other works are all under contracts, of which some are executed, and the rest in a rapid course of completion. The tedious and expensive, but essential operation, of preparing and securing, for all of them, a strong and permanent foundation, is three fourths done. For a minute account of their location and dimensions, we refer to schedule number two, in the appendix.

On the south side of the canal, the ground always rises, in most places gently, but in some abruptly. And, in these elevations, within from one to eight miles of the line, are contained inexhaustible quantities of lime and sand-stone. The wants of the country have not yet required, that many quarries should be extensively opened. But, we found some of an excellent quality, that had been. To such we have had reasonable resort: and we have been very fortunate, in opening several new ones. The prices we have given, for the purchasing, quarrying, and delivering, of large, thick, solid, durable, and well faced stone, has varied from seventy-five cents to one dollar and thirty-seven cents, per ton, according to circumstances. We have, in all cases, chosen to agree for stone, by weight rather than by the cord, or perch, because it lessens the temptation of contractors, to spoil them for our use, by breaking them up into small pieces, which would make them easier to handle, and increase their measurement. And the expense, of erecting scales and weighing them, is not greater than that of piling them up, into compact heaps, for measuring.

There will be nine locks, upon the Middle Section, including one, at the west end, to facilitate communication with the Seneca river, at high and low water. As the locks of a canal are contrived, for the purpose of effecting a passage from one elevation to another, they must always be subject, while they are shut, to the pressure of a considerable head of water, and while they are filling and discharging, to the force of a rapid current: and, as they must be made as small as the nature, of the transportation through them, will admit, they will be liable to violent impingements from heavy loaded boats. With us, they are also exposed to injury, by the intense frost of winter. It will be perceived, therefore, that, in the construction of them, great care and fidelity are indispensable. The site, which ours will occupy, is uniformly excellent, consisting of gravel mixed with loam or clay, in such proportions as to render it close, heavy, hard and water-tight.

We have let out, the laying and securing of the foundations, the framing and placing of the mitre-cills, and the construction and hanging of the gates, of eight of these locks, to a single individual of skill and responsibility, who has heretofore been engaged, in similar undertakings. The stone-cutting and masonry are more distributed. For the performance of these, we have entered into five agreements, with men, whom we believe to be expert and trustworthy, some of them, from our own knowledge, and the rest from satisfactory recommendations.

The foundations, of these eight locks, are to consist of a solid flooring, of hewed timber, one foot thick, and covered with well jointed three-inch-plank, over which, within the chamber, will be laid another flooring, of two-inch-plank, accurately fitted together with water-joints, and spiked down, so as to prevent leakage: and this foundation is to be strongly supported and guarded by piling. The lock-walls are, to be not less than six feet thick, and sustained, by several massy buttresses, to be laid, in water-cement, and thoroughly grouted—to have all the faces, ends, and beds, of each stone, laid in the front of the wall, together with the hollow quoins, the lock-culverts and the ventilators, well cut—and the whole to be sufficiently cramped together with iron, and coped. The mitre cills and gates are to be of the best construction, and properly fitted, secured, and hung. Having provided, by contract, for all the materials necessary, and the labour to be bestowed upon them, in the construction of these locks; and, having counted the cost, we anticipate their entire completion, for a sum not exceeding a thousand dollars, per foot rise. In schedule number three, in the appendix, may be seen further particulars relating to contracts for stone, and for the locks.

That portion of the canal-line, which we have been authorized to open, is intersected by fifty-two public roads, on which it became our duty to erect bridges. For all these we have made provision; and twenty-one of them are erected. In several instances, where the canal has traversed a farm, in such a direction and extent as to forbid the owner to occupy it all, without a bridge, we have paid a reasonable sum, for the construction and reparation of such bridge; and, in consideration of such payment, obtained from the owner a perpetual discharge, for the state, from all further obligation relating thereto. And, to prevent these occupation-bridges from ever interfering with the navigation, a suitable plan, for their construction, was made, of which a full description was always given to the builder.

It may not be improper to state, here, that the gentlemen appointed, by the supreme court, to appraise damages upon the Middle Section, have examined, decided upon, and certified, the most urgent cases of that kind; and the whole amount of claims upon us, which they have yet authorized, is sixteen hundred and eighty-six dollars. A list of all the cases decided, with the amount of damages allowed in each, constitutes number four, of the appendix.

The Middle Section is ninety-four miles long.

Every thing that was to be done, on this section, is now either completed, or under contract and to be completed, by the first of October next; except

1st. A few occupation-bridges;

2d. A small culvert, to pass the waters of a mill-pond, in Whitestown;

3d. A lock, to effect the proper connexion with Seneca river, and a short section of the line adjoining it. The materials, for the construction of the lock, may be delivered by water: And, it was so late in the season, before the precise location, of the lock and section, could be ascertained, that no advantage would have been secured, by contracting for them this fall. We have reasonable propositions, from good men, to finish them both, in September next.

4th. About a mile of the line, on which the original undertaker has failed, for which we can make effectual provision, in the spring.

What is actually done may be understood from the following summary, to wit:—

1st. All the grubbing and clearing is done, except about five miles.

2d. Eight miles of excavation and embankment are completed, inspected and accepted.

3d. Forty miles more have all the excavation and embankment performed; and the frost alone has prevented their being finished. When that is dissolved, and the earth is dry, fifty cents a rod, will entirely complete them.

4th. Ten miles more are about half done.

5th. Twenty-one miles more, are a quarter done.— There remains, on the Middle Section, fourteen miles more, lying in detached pieces, which are yet unbroken.

The most costly embankments were to be made at Nail-creek, at Sedaqueda-creek, at Brown brook, at Brandy brook, at Oneida-creek, at Canastota-creek, at Olcott's brook, at Canasaraga-creek, at Chitteningo-creek, at Beaver-dam-creek, at the outlet of the Little lakes, at Limestone-creek, at Cadwell's swamp, at Butternut-creek, at Onondaga-creek, at Harbour-creek, at Geddesburgh, at the west end of section 37, at the Skeneateles out-let, at Bread-creek, at the Owasco out-let, at Great brook, and at Crane brook. Of these embankments, the nine most expensive are completed, and the residue, in the average, half completed.

Two thirds, of all the deep cutting, is accomplished.

The whole number, of expensive foundations required, was seventeen, of which ten are sunk and secured, and the rest, in considerable forwardness.

The timber, for the waste-weirs, is now felling, and hewing, and sawing; and their construction, is all stipulated for, at about four dollars, per foot run.

The whole amount of mason-work necessary, in culverts, aqueducts and bridges, is one fourth done.

The timber for the lock-sites is preparing; the requisite quantities of stone, for all purposes, nearly quarried; and the scales to weigh them all erected.

The only expensive dam, on the whole route, is that at the Oriskany-creek, which is to be built for $5,700, and is already in some progress.

Taking into consideration every item, of material and of labour, actually provided and paid for; and comparing them with every item remaining to be provided and paid for, in order to the enjoyment of a navigable communication, between the Mohawk and Seneca rivers; and it is our opinion, that the proportion of the former to the latter, is nearly as two to one.

The whole estimated expense of the canal, from Utica to the Seneca river, including a proportional part of the general allowance, for utensils, work-shops, barracks for the men, &c. as stated, in our Report of 1817, is as follows, to wit:—

From the west end of the old canal, at Rome, to Seneca river,	$853,186
From the east end of the old canal, at Rome, to Nail-creek, in Utica, exclusive of locks, the distance being 14 miles,	108,128
Add eight feet lockage between Rome and Utica, at $1,250 per foot,	10,000
„ Twelve road bridges, at $500,	6,000

„ Forty-two occupation-bridges, at $200,	8,200
„ The proportional part of the general allowance above mentioned, is	17,337
„ The expense, of widening and deepening the old canal, was not included, in the Report of 1817, but was estimated, in another place, at	4,000
„ For superintendance of engineers, &c. from west end of old canal, at Rome, to east side of Nail-creek, at $1,000 per mile,	15,000
Aggregate amount,	$1,021,851
The whole amount of actual disbursements, is	578,549
Which being deducted from the estimates, leaves the sum of	$443,302

applicable to the completion of the Middle Section.

This sum is believed to be more than sufficient for that object. And, if the present winter shall afford five weeks of good sleighing to draw stone, and the next summer shall not be unfavorable, the Commissioners entertain sanguine hopes of being able to pass, in a boat, throughout this section, before the next meeting of your honorable body.

Believing we were authorized to institute and carry on further surveys, on the Eastern and Western Sections, of the Erie canal, Isaac Briggs, Esq. has been employed to explore, and re-survey, and locate, the line of the canal, from Utica towards the Hudson river. Such a location he has made, for upwards of forty miles, including all the difficult places, at Herkimer and the Little-Falls. Of his work, he has made ample returns and estimates, accompanied with elegant maps, and profiles, which are herewith presented. From his estimates, it appears, that the cost of opening the canal, through that portion of the line, will be less than our first calculations.

In pursuance of that part of the law, relating to their duties, which requires the Canal Commissioners to recommend such measures, as they may think advisable, for the accomplishment of the objects intended by the legislature; we beg leave to recommend;

1st. That adequate provision be made, for opening a navigable side cut, in the course of the ensuing summer, from the main canal to the salt works, at Salina. This may be performed in six months, at an expense not exceeding six thousand dollars; and, as the main canal is expected to be navigable to the waters of the Cayuga and Seneca lakes, on the one side, and to those of the Mohawk river, on the other, by the close of the next season, it is apparent, that such a side cut would immediately become profitable.

2d. That the militia law be so modified as to excuse from militia duty all persons actually engaged in labouring on the canal. Such labourers are, for the most part, in situations which do not permit them to be properly armed and equipt: They cannot therefore be useful on the parade ground. And, upon a reasonable calculation, there were, during the past season, twenty thousand dollars worth of service lost to the canal, by militia interruptions.

3d. That a law be passed, the present session, authorizing and providing for, the entire completion of the Erie canal. Sufficient experience has now been acquired to establish the practicability of such a measure, within the means of the state. And surely, the prosperities, which it will advance,—of an agricultural, a commercial, and a manufacturing,—of a public, and a private,—of a pecuniary, a literary, a political, and a moral, character, commend it to your patronage. It appears to us to be a measure involving the highest earthly interests. And, illustrious as our country has become, for the utility and glory of its achievements, it never had a legislative body, engaged in a measure teeming with benefits, so various, so extensive and so durable, since the cry, of "land, land," was first heard, from one of the ships of its great discoverer. If honour be coveted, solid and expansive as "the great globe itself, and all which it inherits," the accomplishment of this work will ensure its attainment.

Dated 25*th January*, 1819.

DE WITT CLINTON,
S. VAN RENSSELAER,
MYRON HOLLEY,
S. YOUNG,
EPHRAIM HART.

N. B. Mr. Hart was appointed a Canal Commissioner in the room of Joseph Ellicott, Esq. resigned.

And, in relation to the Champlain canal, the Commissioners Report—

That, since the first of June last, when the season became favorable, the excavation of the Champlain canal has been vigorously and successfully prosecuted. More than twelve miles have been completed, to the satisfaction of the Engineer, and a final settlement has been had with the contractors.

The remainder of the excavation is in such a state of advancement, that two months of good weather will ensure its completion, as there is not more on the whole line remaining to be done, than the average excavation of two and a half miles. Considerable progress has been made towards the construction of the artificial works. The stone for the locks have been quarried; more than half of them, it is believed, are already delivered at the places where they are to be used, and a considerable portion of them are hewn, and ready to be laid into the work. The timber, the lime, and the sand, are also in a very advanced state of preparation. The materials for the culverts, waste-weirs, bridges, &c. are in such a state of forwardness, that there is little doubt but they will all be prepared and delivered before the breaking up of winter: and unless the next season should be uncommonly bad, it is confidently expected, that within ten months from this time, the Champlain canal, from the Lake to the Hudson, will be fit for navigation.

The amount of labor which has been performed the last season, compared with the expenditures, fortifies the opinion expressed in the Report of last season, that the Champlain canal will be finished for a sum not exceeding the estimates; and the Commissioners respectfully recommend the passage of a law, authorizing its construction from Fort Edward to the tide waters of the Hudson.

25th January, 1819.

DE WITT CLINTON,
S. VAN RENSSELAER,
S. YOUNG,
MYRON HOLLEY,
EPHRAIM HART,

APPENDIX.

No. I.

A detailed Statement of Contracts for Excavation and Embankment on Middle Section of the Erie Canal.

Names of Contractors.	Nature of Contract.	Progress of Execution.								Payments made thereon.	
		completed		nearly completed		half done		one fourth done			
		Mls.	Chs.	Mls.	Chs.	Mls.	Chs.	Mls.	Chs.		
Beckwith & Slayton	Exca. & Emb'kt.				14					$ 2,490	
N. Hempstead	" "				17					2,700	
Dexter, Pease & Moseley	" "	3					10			18,000	
D. Loomis	Emb'kt.				7					1,300	
Mann & Walcott	Exca. & Emb'kt.		23							3,106	50
Joseph Miller	" "		46							1,750	
Timothy Hunt	" "			1			30		10	6,710	
James Donaldson	" "				10					520	
James Lynch	" "	1								6,050	
Ezra Hovey	" "				25		30		20	3,750	
J. &. A. Waggoner	" "				55		30		34	7,171	
J. Brainard	" "			1	64					13,945	50
J. Hathaway	" "				65		20		12	11,437	50

E. Chapin	”	”		60	30		$ 15,315
Joseph Miller	”	”		75			6,500
J. Richardson	”	”	60				4,094
J. Seymour	”	& Emb'kt.	20	25	20		3,921
A. Brayton	”	”		10		15	2,000
Selden & Edgerton	”			40			3,450
Comstock & Miller	”	& Emb'kt.		40		20	5,450
G. Seton	”	”		22		6	1,750
M. H. Farservice	”			45	15	15	4,700
J. Colburn	”	”			40		5,700
P. Lyon	”			15	15		1,370
Hibbard & Ackley	”				20	20	1,650
Parker & Collins	”			20			1,000
Wooley, Joslin, Barber	”			50	15	15	5,000
J. Burrows	”			12	4	4	1,300
Halsey Collins	”	”		40			2,420
P. Harger	”			50	12	12	4,900
C. & H. Adams	”	& Emb'kt.		1 62	12		16,900
J. Edgerton	”	”		28	20	10	7,060
Carried forward,			5 69	13 51	4 03	2 33	

Names of Contractors.	Nature of Contract.	Progress of Execution.								Payments made thereon.
		completed		nearly completed		half done		one fourth done		
		Mls	Chs.	Mls.	Chs.	Mls.	Chs.	Mls.	Chs.	
Brought forward,		5	69	13	51	4	03	2	33	
N. Raymond	Exca. & Emb'kt.				50		20		6	$ 5,950
J. Landon	"				35		30		30	4,950
J. Van Camp	"				20		20		30	3,750
S. Holliday	"				15		10		25	2,300
Joseph Olcott	" & Emb'kt.				60		6		10	5,600
A. Fuller	"				12				15	1,300
W. Cotton	" "				50				30	6,850
Zebulon Douglass	Exca.				15		10		40	2,650
J. Chapman	Emb'kt.				20					5,700
S. W. Bond	Exca.				25		10		40	2,950
Brown & Hall	"				35		15		60	5,450
Abercrombie	" & Emb'kt.				23					2,900
Cady & Harris	" "				20				15	3,050
D. Eggleston	" "				40		20	1	20	6,850
Sage & Bangs	"				10				46	2,600
Bailey & Edwards	"				20		10		55	3,900
R. Noble	"								25	1,200

Gay & Wilcox	”			26			$ 3,550
J. Richardson	”	& Emb'kt.		2 5	10	35	19,950
N. Woolaver	”			20	5		850
E. Gumaer, Jun.	”	& Emb'kt.		1 20	20		20,000
Vroman & Hempsted	”	”		45			2,800
E. Cadwell	”	”	45				9,119 01
Teal & Bangs	”	”	57				4,130
Olcott & Leonard	”	”		1 37			15,300
S. Bronson	”		1 13				6,400
R. Parsons	”	”				45	2,650
J. Ingalls	”			25	10	45	3,850
S. N. Dexter	”	& Emb'kt.		60	20	45	9,650
E. Gumaer, Jun.	”	”		60	30	40	8,300
A. C. Hoar	”			40		20	2,800
Whitney & Crocker	”			30		40	3,000
J. Ives	”			35	21	45	3,750
C. Hatter	”			50	10		3,100
J. Crocker	”			25	25	5	2,150
J. B. Olcott	”			35	18	35	3,250
Carried forward,			8 24	29 54	8 03	13 35	

Names of Contractors.	Nature of Contract.	Progress of Execution.								Payments made thereon.
		completed		nearly completed		half done		one fourth done		
		Mls.	Chs.	Mls.	Chs.	Mls	Chs.	Mls.	Chs.	
Brought forward,		8	24	29	54	8	03	13	35	
H. Bogardus	Exca.				32		15		28	$ 4,150
R. Lloyd	”				15		15		25	2,652
E. Griffin	”				20		12		8	2,400
F. Lasher	”				40		12		36	7,350
C. Clark	”				15		5		9	1,480
A. Scott	”		40							1,884 81
J. Baldwin or Brown	” & Emb'kt.				50		22		20	4,000
Hoar & Barse					20		20		20	2,250
D. Eggleston	Exca. & Emb'kt.						10		40	1,400
Griswold & Bender	”				50		15		30	4,200
C. Moseley	” & Emb'kt.				45		20		35	3,000
B. Gumaer	” ”				75		20		25	6,000
A. Wilson, (now Scott)	” ”				30		10		15	2,372
Gay & Raymond	” ”				25				64	3,900
J. A. Sherwood	” & Emb'kt.				70		9		10	4,550
M. Benedict	” ”				60		15		15	4,600
Richmond & Hamilton	”				40				20	2,025

C. Moseley	”					31				18	$ 3,000
Potter & Babcock	”					46				14	3,150
C. Moseley	”	& Emb'kt.				30		5		10	3,000
W. Hempstead	”					40				35	2,700
Joslin & Cadwell	”	& Emb'kt.				30				50	4,000
Tyler & Hovey	”	”				70				50	4,800
			8	64	40	08	10	48	20	52	

Most of the eight miles and sixty four chains, (above mentioned to be completed,) and several places on those sections which are nearly completed, are filled with water, into which a few boats have already been introduced.

No. 2.

A Table, shewing the location, dimensions, &c. of the Aqueducts, Culverts and Waste-Weirs, on the Middle Section of the Erie Canal.

Of the Aqueducts.

LOCATION.	LENGTH.	MATERIALS.
At Sedaqueda creek,	240 feet.	Stone and wood.
„ Wood creek,	40 „	Do.
„ Oneida creek,	120 „	All stone.
„ Canasaraga creek,	40 „	Stone and wood.
„ Chitteningo creek,	110 „	Do.
„ Limestone creek,	110 „	Do.
„ Butternut creek,	110 „	Do.
„ Onondaga creek,	180 „	All stone.
„ Nine-Mile creek,	120 „	Do.
„ Skeneateles out-let,	100 „	Do.
„ Cold Spring brook,	100 „	Stone and wood.
„ Owasco out-let,	120 „	All stone.
„ Crane brook,	100 „	Stone and wood.

In the Report of 1817, the above aqueducts were all estimated to be of wooden trunks, resting on stone abutments and piers.

Of the Stone Culverts.

Location.	*Span of the Arch.*	*Length.*
At Nail creek, . . .	14 feet. . .	70 feet.
„ Stoney creek, . .	15 „ . .	64 „
„ Brandy brook, . .	10 „ . .	64 „
„ Beaver-dam creek,	10 „ . .	64 „
„ Little lakes, . . .	8 „ . .	72 „
„ Harbour creek, . .	10 „ . .	72 „
„ Hughes' creek, . .	4 „ . .	120 „
„ Great brook, . .	10 „ . .	64 „

Of the Iron Culverts.

Location.	*Diameter.*	*Length.*
On Section L, . . .	3 feet. . .	69 feet.
„ do. I, . . .	do. . .	75 „
At Swamp brook, . .	do. . .	69 „
„ Brown brook, . .	do. . .	60 „
„ Rush creek, . .	do. . .	75 „
„ Black creek, . .	do. . .	75 „
„ Mud creek, . . .	do. . .	75 „
Near Cowaston creek,	do. . .	75 „
Near Chitteningo creek,	do. . .	72 „
At Cadwell's swamp, .	do. . .	75 „
„ Whipple's, . . .	2 feet, . .	63 „
On Section No. 11, .	do. . .	69 „
On Section No. 10, .	do. . .	69 „
Near Barker's, . . .	1 foot, . .	60 „
Near Loomis', . . .	do. . .	60 „

The above iron culverts, consist of pieces cast, in the shape of half cylinders, with flanges, and connected together, with nuts and screws. They were contracted for, at the rate of $89 per ton delivered; and the whole expense of them when properly laid and secured, has been, of those that are three feet in diameter, about $500 a piece, of those that are two feet in diameter, about $340, and of those that are one foot in diameter, about $170.

◆

Of the Waste-Weirs.

Location.	*Length.*
At Shepard's brook, ...	100 feet.
„ Section C., ...	100 „

At Wood creek, near white house,	150	feet.
„ Section No. 5,	100	„
„ Drum creek,	100	„
Near Oneida creek,	100	„
At Cowaston creek,	150	„
„ Canastota creek,	100	„
„ Olcott's brook,	60	„
„ Pool's brook,	100	„
„ Mill creek,	100	„
„ Hand's brook	100	„
„ Camp's brook,	100	„
„ Carpenter's brook,	150	„
„ White bottom brook,	100	„
„ Bread creek,	150	„
„ Tyler's brook,	100	„

The expense of these waste-weirs was not included in our estimates of 1817.

No. 3.

Schedule of the Contracts for Stone and for Locks on the Middle Section of the Erie Canal.

Names of Contractors.	*Quantity of Stone*	*Place of delivery.*	*Price.*
Theron Newell,	320 tons.	Nail creek.	$0.95 per ton.
Blackstone & Mason,	600 ”	do.	0.95 ” ”
Edward Blackstone,	100 perches.	Sedaqueda creek.	1.06 ” perch.
Story, Rice & Simpson,	2000 tons.	do.	0.95 ” ton.
Cagwin, Joslin, Allen, &c.	800 ”	Wood creek and B. brook.	1.00 ” ”
Butlers & Hamlin,	210 cords.	The same.	various.
Jerh. Brainard,	300 ”	Oneida creek.	various.
Eliphalet Hotchkiss,	3400 tons.	The same.	1.19 per ton.
Luke Hitchcock,	800 ”	Brandy Brook.	1.25 ” ”
Benjamin Watson,	200 cords.	Oneida creek.	5.00 ” cord.
Mancel Talcott,	400 ”	The same.	do.
Nehemiah Tower,	75 ”	Three bridges.	4.50 ” ”
Martin Vrooman,	325 ”	Canasaraga & Chitteningo.	do.
Lacey & Daniels,	1050 tons.	The same.	0.81 per ton.
Caer & Raymond,	75 cords.	Little lakes and bridges.	6.00 per cord.
Aaron C. Hoar,	250 ”	Limestone & Butternut creek.	4.50 ” ”
The same,	550 tons.	The same.	0.75 per ton.
Oliver Teall,	3000 ”	Onondaga creek.	0.81 ” ”

Names of Contractors.	*QuantityofStone*	*Place of delivery.*	*Price.*
Joseph Griswold,	3000 tons.	The same.	$0.81 per ton.
Frederick Lasher,	5964 "	Three Locks at Salina, &c.	$0.87\frac{1}{2}$ " "
Enoch Griffin,	500 "	Onondaga creek.	0.81 " "
Hubbard & Dodge,	2500 "	Harbour creek and Lock.	0.81 " "
John Westcott,	6700 "	Nine-Mile creek.	0.81 " "
Levi Paddock,	360 "	Road bridges.	0.81 " "
Benjamin Gumaer,	4014 "	Skeneateles out-let.	1.00 " "
Calvin Love and others,	2400 "	Owasco do. &c.	1.25 " "
Hempsted & Harris,	2194 "	Lock near Owasco,	1.25 " "
Leonard Babcock,	400 "	Owasco.	1.25 " "
William Ward,	4200 "	Lock on 64, and aqueducts.	1.31 " "

Besides the prices above mentioned, in several instances, we have agreed to pay for the stone in the quarry from three to four cents per ton. All the contracts by the cord or perch were made in 1817: most of those, by the ton, were made in 1818. And in addition to the contracts mentioned, in the preceding table, a great many have been made, for small quanties of stone to be delivered, at the iron culverts, &c.

OF THE LOCKS.

Names of Contractors.	*No. and Site of Locks.*	*Lift of Lock.*	*Amount of Advances.*
Hazard Lewis,	2 near Salina,	10 feet each.	$500
John M'Intyre,	2 east and west of Cossit's,	6 " "	1500
Ara Broadwell,	1 at Nine-Mile creek,	11 " "	none.
John & Samuel Horne,	1 at Skeneateles,	11 " "	250
Murray & M'Nab,	1 on Section 64,	9 " "	750
Luther Doolittle & Son,	1 Owasco out-let, .	9 " "	none.

The above named contractors for locks have, all but Mr. Lewis, undertaken other stone work, on the line, a part of which is done, as stated in the Report. The prices given for the masonry of the locks, inclusive of stone-cutting, &c., is three dollars per perch of sixteen and a half solid feet, except in one case, where eight dollars per perch, is given for the first foot solid measure, on the inside face of the walls, and one dollar and fifty cents, per perch, for the residue of the lock walls.

No. 4.

A list of cases, in which claims for damages, on the canal-line, between Utica and Seneca river, have been decided upon, and certified, by the Appraisers, together with the amount of damages in each.

Names of Claimants.	*Amount of damages allowed.*
Leonard Peck	$ 120
John Reed, (an Indian)	30
John Mitchell	80
Olivia Lewis	25
Peter Gumaer	330
Mary Huntley	300
Ira Huntley	30
Heirs in reversion of the real estate of Huntley	1
Samuel Lusk	30
Dennis Rust	more benefitted than injured
William Brown	the same
Robert B. Cunningham	the same
Benjamin Simpson	the same
John Johnson	the same
John Nicholson	$ 30
Calvin Corey	30
Ephraim Emerick	75
Benjamin Rooker	25
Recompense Sowle	50
Frederick Real	30
Henry Kip	350
John Hecox	more benefitted than injured
William G. Tracy	the same
Daniel Wiles	$ 50
Eli Hays	100
Aggregate sum is	$ 1,686

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